

terminal's signal strength in an acceptable range during a prolonged transmission. Instead, mobile terminals simply transmit messages repeatedly, with increased transmit power on successive attempts, until the base station acknowledges reception of the message. Because longer messages are more susceptible to errors caused by interference or fading, the mobile terminal's power level may reach very high levels when attempting to send a long message. This would result in excessive interference to other users during the transmission. On the Paging Channel, moreover, long packets cannot be supported because of the structure of the channel. Messages are limited to a maximum of 255 octets, and no mechanism exists for fragmenting longer messages.

The Access Channel also is incapable of identifying multiple propagation paths. On Traffic Channels, each of the mobile terminals has a unique spreading code that is used by the base station to identify and exploit multiple propagation paths, using a signal combining method. On the Access Channel, in contrast, all mobile terminals use the same spreading code for transmissions, making multiple propagation paths indistinguishable from transmissions from other mobile terminals.

In some present systems, it is possible to provide connectionless data services, based on the delivery of individual data packets from many users who transmit data packets in bursts. Such services preferably do not utilize fixed allocations of communication resources and allow the sharing of such resources among multiple users. In many present communications systems, and in particular digital cellular systems and CDMA cellular, however, no capability exists to provide for communication of data packets from many bursty users. In such systems, efficient support for connectionless data services requires changes in the access methods used on the radio channel and in the land network.

Therefore, a need exists for a random access data packet channel that can share communication channel resources among a large number of bursty packet data users, each having a variable and unpredictable demand for transmission resources, and for a way to switch between such a random access channel and a dedicated data channel. A need also exists for a coding scheme that can be used to identify users on the random access channel and a scheme for overlaying the random access channel with control channels.

SUMMARY OF THE INVENTION

Accordingly, the present invention is directed to a random access channel for packet data services in a wireless communications system that substantially obviates one or more of the problems due to the limitations and disadvantages of the related art.

Additional features and advantages of the invention will be set forth in the description that follows and in part will be apparent from the description, or may be learned by practice of the invention. The objectives and other advantages of the invention will be realized and attained by the apparatus particularly pointed out in the written description and claims of this application, as well as the appended drawings.

To achieve these and other advantages, and in accordance with the purpose of the invention as embodied and broadly described herein, in a digital communication system for communicating digital information, the digital communication system having a forward link and a reverse link, the invention is a system for communicating a digital data packet. The system of the present invention comprises digital transceivers for sending the digital data packet on a random access channel over the reverse link and for receiving

the digital information from the forward link. The system further comprises a digital base station for receiving the digital data packet on the random access channel from the reverse link and for sending the digital information over the forward link, wherein the digital transceivers make packet service requests on the random access channel and thereby share the random access channel.

In another aspect, in a digital communication system for communicating digital information, the digital communication system having a forward link and a reverse link, the present invention is a method for communicating a digital data packet. The method comprises sending the digital data packet on a random access channel over the reverse link and receiving the digital information from the forward link by a number of digital transceivers. The method further comprises receiving the digital data packet on the random access channel from the reverse link and sending the digital information over the forward link by a digital base station, wherein the digital transceivers make packet service requests on the random access channel and thereby share the random access channel.

In another aspect, in a digital communication system for communicating digital information, the digital communication system having a digital transceiver and a digital base station, the digital transceiver having a bandwidth demand, the present invention is a system for communicating digital data packets. The system of the present invention comprises a random access channel and a dedicated channel for communicating the digital data packets between the digital transceiver and the digital base station. The system further comprises a processor for switching from the random access channel to the dedicated channel if the bandwidth demand exceeds a first threshold level and from the dedicated channel to the random access channel if the bandwidth demand below a second threshold level and/or if the digital transceiver is highly mobile, frequently moving from the coverage area of one base station to the coverage area of another.

In yet another aspect, in a digital communication system having a broadcast channel for communicating system information and an access channel for making access requests, the system information including paging messages, the digital communication system including a plurality of transceivers each having a specific long code, the present invention is a system for communicating a digital data packet. In the system of the present invention, a communicating transceiver from among the plurality of transceivers initializes a packet service request, requests a searcher reservation on the access channel, and sends the digital data packet over a random access channel using the specific long code corresponding to the communicating transceiver to obtain a coded digital data packet. The system comprises a base station, including a plurality of searchers and a controller for locating a free searcher from the plurality of searchers and for sending to the free searcher the specific long code corresponding to the communicating transceiver. Further, the base station assigns the free searcher to the communicating transceiver and receives the coded digital data packet from the communicating transceiver over the random access channel. The plurality of transceivers share the random access channel.

In all of the systems and methods described above and in the following description, the digital data can be communicated over the digital cellular communications system using code division multiple access (CDMA). CDMA is a spread spectrum method of multiplexing transmissions by encoding the transmissions so that they are each distinctive. CDMA